Sustainable Information Systems Management

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1 The ecological and social dimension of information systems management

The increasing dissemination and growing dependency on information technologies (IT) and related services create new unconsidered ecological and social challenges for information systems (IS) management.

Due to this development, IS management is confronted with new demands from business units, customers and employees. A sustainable IS management covers not only the economical, but also the ecological and social perspective, extending traditional concepts of IS management.

The *ecological impact* of IT through its toxic substances, radiation and energy consumption on humans and nature has been investigated for many years (Eder 1994, p. 600 ff). The current discussion about "Green IT" has brought back the ecological impact of IT into the public and academic focus. IT service providers, such as Google, whose 450 000 operating servers consume approximately 800 gigawatt hours electricity per year, account for tremendous amounts of indirect CO_2 emissions (Chou 2008, p. 93). The energy consumption of all servers worldwide approximately equates to the consumption of the entire Polish economy (Koomey 2007).

The *social responsibility* of IS management is outlined by the frequent reports about data misuse connected to IT, in which companies, employees or customers are affected. The handling of data within many companies is described as being challenging (BSI 2009, p. 7). Hence, IS management is coming under increasing pressure from external stakeholders. The social dimension of sustainable IS management includes topics of IT utilization by individuals and organizations, but also comprises the challenges of generating, preserving and safeguarding knowledge, information and data.

2 Sustainability and resource orientation

2.1 History and concept of sustainability

The predominant understanding of sustainability was shaped by the definition of the Brundtland Commission in 1987, which defined "sustainable development" as a "development that meets the needs of the present without compromising the ability of future generations to meet their own needs" (Hauff 1987, p. 57).

At the business level, the concept of sustainability has emerged, based on the objectives of resource conservation and environmental protection, as an equitable and simultaneous consideration of economical, ecological and social objectives, known as the triple-bottom-line concept of sustainability. In this context, sustainable management can be defined as a concept of long-term simultaneous optimization of economical, ecological and social objectives to generate a lasting superior financial performance for the business (Elkington 1997). The triple-bottom-line concept provides a framework for companies to measure and report their performance and organizational success according to these three pillars.

Addressees of a sustainable management are particularly internal (e. g. departments, employees) and external (e. g. customers, owners, suppliers, investors) stakeholders who exert tangible or intangible influence on the organization through various mechanisms of action, thereby, encouraging environmental and social responsible value creation (Freeman 1984). Sustainable IS management responds to the needs of all these stakeholders through the balanced consideration of economic, environmental and social aspects. By doing so, it contributes to the companies' strategic objectives as well as to IS management's critical resources.

2.2 Resource-based view on IS management

In the scope of corporate sustainability, the resource-based view has proven itself as an applicable framework for the evaluation of strategically important corporate resources. In this regard, it needs to be asked which impulse the resource-based view can provide for the development of a sustainable IS management. The traditionally limited focus on resources such as information, communication and IT does not cope with today's role of IS management within corporations. From the standpoint of the resourced-based view the success of IS management results from certain tangible and intangible resources of the organiza-

tion. Referring to this, Wade and Hulland (2004, p. 107 ff) identified from a variety of studies, eight fundamental core resources of IS management. They distinguish these resources in three categories: outside-in, spanning and inside-out resources (**Tab. 1**).

The resource-based view states that a competitive advantage and the related success of a corporate function, in this case the IS management, depends on how it is able to obtain, apply and secure valuable resources in the long run (Wade and Hulland 2004, p. 107 ff).

Tab. 1 Typology of IS resources (according to Wade and Hulland 2004, p. 112)

Outside-In	Spanning-Inside	Out
External relationship management Market responsiveness	IS business partnerships IS management/planning	IS infrastructure IS technical skills IS development Cost efficient IS operations

Tab. 2 Characteristics of sustainable IS management

	Intention of IS management	Primary objectives	Scope of action (Resources)	Primary stakeholders	Responsibility
Reference model of sustainable IS management	Contribution to the vision and the strategic objectives of the corporation	Weighted, short and long-term economical, ecological and social objectives	Information, knowledge, infrastructure, internal and external relations, market responsiveness	Management board, business divisions, customers, partners, employees, suppliers, investors, NGOs, legislators	CIO/COO

3 Framework of sustainable IS management

3.1 Principles and characteristics

Numerous concepts of IS management have established themselves in the German-speaking world. In general, they can be differentiated into problem oriented, task oriented, process oriented, level oriented and architectural oriented concepts (Krcmar 2005, p. 28–47). These concepts already comprise certain aspects of sustainable IS management without emphasizing them.

Based upon the introduced concepts of sustainability and the resource-based view an ideal model of sustainable IS management can be outlined (**Tab. 2**).

The purpose of sustainable IS management is to contribute to the vision, the overall strategy and the strategic objectives of the corporation, which do not only inhere economic, but also ecological and social targets.

These objectives do not only apply to information as a resource but also all other resources identified by the resource-based view. The target group are all primary stakeholders of the IS management. Given the fact that ecological and social topics are integrated tasks of the entire corporation, the main responsibility for IS management might shift to the level of a Chief Operating Officer (COO).

3.2 Management cycle

From the previous parts, the presented aspects of sustainability, the resource-based view, and IS management can be integrated into a management cycle of sustainable IS management (**Fig. 1**).

Tab. 3 Exemplary measures and their contribution to the social and ecological dimension of sustainability (according to Schmidt et al. 2009, p. 7)

Process level of IS management	Social dimension	Ecological dimension
IS sourcing	Employee selection Software selection Audits of suppliers Negotiation of SLAs	Check for certification Check for eco-labels (e.g. Energy Star) TCO analysis
IS operations	Compliance to data privacy and data security Knowledge management (e. g. Web 2.0) Knowledge generation Use of standards (e.g. ITIL) Workstation concepts (Shared Desk) Communication management (e. g. instant messaging)	Virtualization concepts Grid computing Cloud computing Thin clients Cooling concepts in data centers Wake-on-LAN Compliance to standards and laws
IS delivery	Social marketing Training of customers and employees Documentation of projects Stakeholder relationship management	Eco-marketing Publication of an ecological balance sheet Stakeholder relationship management

The stakeholders' needs are at the core of all planning considerations by sustainable IS management (**Fig. 1**, (1.)). Depending on their significance and power of influence, weighted short and long-term economical, ecological and social objectives are derived, based on the triple-bottom-line concept for sustainable management (**Fig. 1**, (2.)). Sustainable IS management achieves these targets by obtaining, applying and securing its essential resources (**Fig. 1**, (3.)). The implementation is done based on the meta-model of Business Engineering on the strategic, process and system level of IS management (Österle and Blessing 2000) (**Fig. 1**, (4.)). Finally, concrete measures and different scopes of action from IS management meet the demands of these stakeholders. Various topics, currently discussed, for example service orientation or grid computing, can be motivated by the objectives sustainable IS management tries to accomplish (**Fig. 1**, (5.)).

Measures from the scope of "Green IT" for instance are improving the economic and ecologic impact by cutting energy consumption (Buhl et al. 2009, p. 55). Thereby demands from the management boards, the business units or from employees and customers are addressed. The resources which are playing an important role in this context are primarily the infrastructure, the internal and external relationships, and the market responsiveness. For this reason the model of sustainable IS management has the ability to illustrate complex relationships and effects between stakeholders, objectives and measures.

3.3 Measures and implementation on the process level

Individual measures can be assigned to the levels of IS management. Server vir-

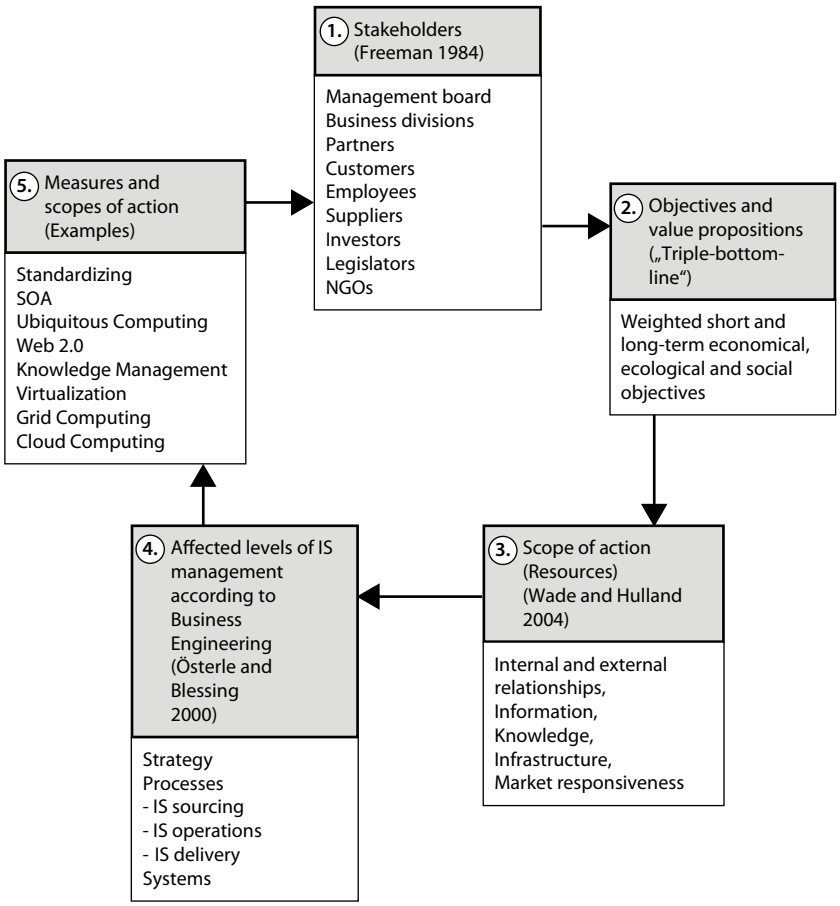

Fig. 1 Management cycle of sustainable IS management

tualization in the data center for example, primarily touches the levels of IT operations processes and systems, whereas more complex measures such as grid or cloud computing, require change to the overall strategy, the processes and the systems of IS management.

In this way, current measures can be classified. Following Schmidt et al. (2009), at the process level of sustainable IS management, the ecological and social dimension can be linked within in a portfolio analysis. This approach results in a variety of possible combinations (**Tab. 3**). Therewith, it can be shown which influence a measure can have besides the single-focused economic dimension.

4 Importance for Business and Information Systems Engineering Research

Ecological and social topics related to IS management are likely to gain importance in the future. On the one hand the global share of IT induced CO_2 emissions will increase until 2020 to three percent. On the other hand IT is an enabler for intelligent business and production processes or environmental software applications and can therefore contribute to responsible resource consumption within corporations (Buhl et al. 2009, p. 54 ff). These inward-looking and outward-looking perspectives are integrated in the concept of sustainable IS management.

For Business and Information Systems Engineering (BISE) research, the explicit consideration of stakeholders, sustainability objectives and resources provides a holistic structural approach and opens up a new research area with a multitude of research questions. Topics for further investigation include the question, such as identifying measures IT could contribute to satisfy the specific ecological and social needs of single internal and external stakeholder groups. In this context, opportunities and risks of the increasing interconnectedness need to be evaluated to deduce implications for the companies' IS management. If IT develops like other industries, for instance, the automotive industry, the importance of ecological and social topics as well as regulatory conditions is likely to increase. In many large-scale enterprises, the business units already specify quantitative sustainability targets for their IT. Therefore, the complementation of existent IS management models seems reasonable.

By a stronger integration of social science and a renaissance of the resource-based view, BISE research can develop a broad, socially relevant field of research and contribute to its systematic investigation in the future.

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